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THE SURGICAL PROBLEM IN PROSTATIC HYPERTROPHY.

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THE hypertrophy or overgrowth of any organ, in one or all of its tissue elements, presents two morbid anatomical changes: (1) An increase in the number or size of the cells of which it is composed. (2) Displacement of contiguous structures (other organs and tissues) due to the expansion of the hypertrophied organ, for physical laws teach us that no structure, surrounded by other structures, can enlarge without displacing them. The change in the *gland itself* becomes of pathologic significance only when increased functionating power results in functional overproduction, and in the upsetting of economic equilibrium of the physiologic system to which the organ belongs and, under such circumstances, becomes clinically manifest by symptoms referable to the *organ itself*. The second morbid change, the displacement of *other organs*, only becomes of pathologic significance when such displacement causes interference with the function of the displaced organs and becomes clinically apparent by symptoms referred to them.

The rôle of the hypertrophied prostate, as a pathologic condition,* is purely a mechanical one. It is only because its expansion causes displacement of the urethra and bladder, and thereby interference with the evacuation of urine, that it becomes of pathologic importance and clinically manifest. If hypertrophy of the prostate did not cause vesico-urethral displacement sufficient to impede urinary evacuation, it would excite no more clinical interest than the opposite condition of atrophy of the prostate. This is evidenced by the fact that hypertrophy may and does exist for many years † before its presence becomes known by urinary obstruction, and in about one-half ‡ of all cases it exists without notice or harm from the time of its inception till death in old age.

When the harmless overgrowth of any organ causes pressure displacement and disturbance of the proper function of

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* The simple hypertrophic changes in the prostate also offer in moderate degree fertile conditions for carcinomatous degeneration. Greene and Brooks (*Journal of the American Medical Association*, April 26, 1902), from their histologic study upon the prostate, conclude that, while true neoplasms of the prostate are rare and have no concern in the development of hypertrophy, carcinoma is apt to arise in the hypertrophied organ. Albarran and Halle (*Ann. des. Mal. des Org. Gén.-Urin.*, February and March, 1900), in fourteen out of 100 prostates, found evidence of atypical adenoma which they considered the transformation stage from hypertrophy to carcinoma. Oraison (quoted in *Journal of the American Medical Association*, July 25, 1903) mentions twenty-eight cases of carcinoma in a total of 306 prostatic subjects during the last three years in Neckar Hospital, a little less than 10 per cent.

† Although prostatic hypertrophy is not observed clinically and does not cause urinary obstruction till after middle life, Lydston and others advanced the belief that enlargement often began in the third decade, upsetting the creed of Thompson and the older writers, who considered enlargement essentially a senile condition, and denied its existence before the fiftieth year. Socin and Burckhardt ("Die Verletzungen und Krankheiten der Prostata," Stuttgart, 1902, p. 80) have verified this new thesis by pathologic research. Their investigations upon 300 post-mortem sections of men over thirty-six years at the Basel Institute showed prostatic hypertrophy in 101. Of those between the ages of thirty-six and forty hypertrophy was found in 13 per cent.; between forty and fifty, 25 per cent.; fifty and sixty, 31 per cent.; between sixty and seventy, 56 per cent.; between seventy and eighty, 50 per cent.; and between eighty and ninety, 54 per cent.

‡ According to Sir Henry Thompson, 34 per cent. of all men attaining the age of sixty have hypertrophical prostates, but less than half of these suffer from the disease.

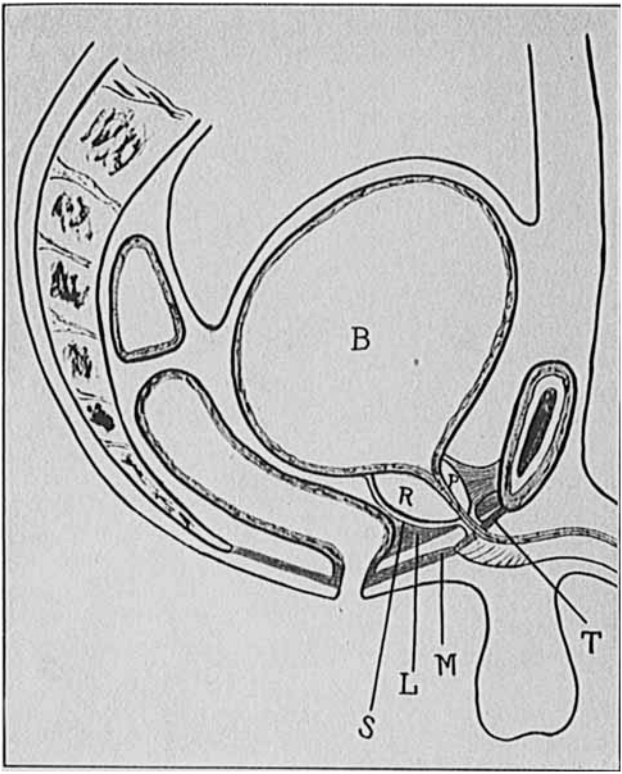

FIG. 1.—Diagrammatic sagittal section of the male pelvis showing the pre- and retro-urethral portions and their relations. R, Retro-urethral or surgical prostate; P, pre urethral prostate; B, bladder; S, prostatic sheath or ligament; L, levator ani of left side; M, recto-urethral muscle; T, triangular ligament or diaphragma urogenitale.

another organ, it is not the offending but the offended organ which requires relief. In prostatic hypertrophy, then, we are not asked to treat the prostate, but the bladder. When an organ requires relief because by displacement its function is interfered with, natural efforts of relief would be directed towards preventing displacement or correcting it sufficiently to permit of proper performance of its function.

Since the problem presented in the prevention and correction of any displacement is largely a mechanical one, requiring for intelligent solution a study of the forces producing and maintaining displacement, before considering methods of relief for vesico-urethral displacement due to prostatic hypertrophy, let us study the prostate and its surrounding structures, the mechanism of vesico-urethral displacement, and of urinary interference.

The prostate is described as a cone-shaped organ about the size of a horse-chestnut, with its base directed upward and slightly backward towards the bladder and its apex facing downward and slightly forward towards the triangular ligament. It has two lateral lobes and two commissures,—the anterior commissure joining the lateral lobes in front, and the posterior uniting them behind the urethra. The lobulated prolongation of the posterior commissure upward and backward between the ejaculatory ducts is known as the middle or third lobe of Home. The first portion of the urethra with its enclosing muscle, the sphincter urethræ prostaticus (Kohlrausch), passes downward and forward between the lateral lobes of the prostate from base to apex directly behind the anterior commissure. In relation to the urethra, the prostate can be divided into the *pre-* and *retro-urethral* portions, four-fifths to five-sixths of the gland lying behind the axis of the urethra and only the small anterior commissure in front. This relation is important as regards displacement of the bladder and urethra. The prostate is composed of glandular, muscular, and fibrous tissues. The former is distributed almost wholly in the lateral and middle lobes, the anterior isthmus or commissure containing but little, being composed almost entirely of muscular and fibrous tissue, which are also distributed irregularly throughout the rest of the organ from the periphery to the urethra. The fibrous tissue spreads out on the periphery to form the dense true capsule of the prostate. Externally, the prostate is surrounded (except its base, which is placed directly against the bladder) by a strong fascial sheath reflected from the posterior layer of the triangular ligament from the apex to the base of the prostate, and thence upon the bladder. This sheath encloses the prostate like a collar and, where it meets in front, passes forward to the pubes to form the puboprostatic ligament. This collar-like sheath with its attachment to the pubes serves as the suspensory ligament of the prostate, holding it up, and with it the neck and floor of the bladder.* This sheath has also been called the capsule of the prostate, but cannot rightly be so considered because it is not derived from the prostate but from the pelvic fascia; it does not surround the whole organ but only its sides, and is but loosely joined to it. Of other relations to the prostate, we have the bladder floor and neck above; the pubes and pubic arch supporting the triangular ligament in front; the inner separated margins of the levatores ani and the rectum and posterior half of the perineum below; and the rectum and the ejaculatory ducts behind.

The Mechanism of Vesico-Urethral Displacement.—The displacement of the bladder and urethra resulting from prostatic enlargement depends primarily upon the relation of the portion which enlarges to the urethra and bladder. Thus the *pre-urethral portion,* situated in front and above the neck of the bladder and urethra, can only cause displacement backward and downward, while the *recto-urethral* portion, situated behind and below the urethra and vesical neck, results in upward displacement. While great expansion of the pre-urethral prostate might result in marked displacement, as a

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* Retzius evidently ascribed this function to the prostatic sheath when he named it the *ligamentum pelvioprostaticum capsulare.*

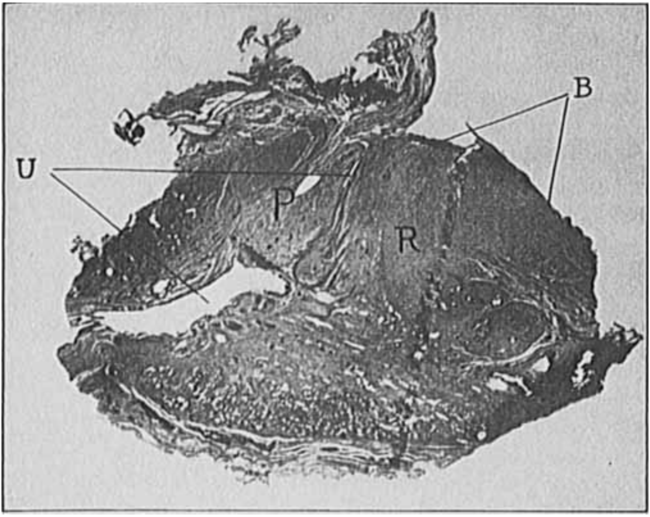

FIG. 2.—Sagittal section of an enlarged prostate (actual size) showing vesico-urethral displacement. R, Retro-urethral prostate; P, pre-urethral prostate; B, bladder-floor; U, urethra.

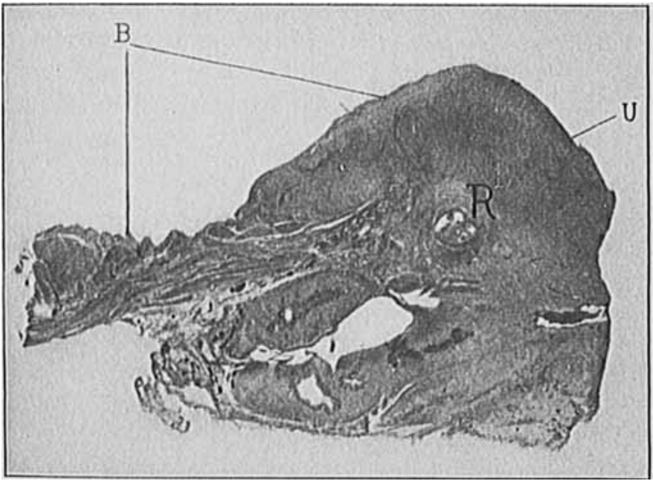

FIG. 3.—Sagittal section of enlarged retro-urethral prostate (actual size) showing elevation of vesical outlet and distortion of prostatic urethra. R, Retro-urethral prostate; B, bladder-floor; U, urethral floor.

matter of fact, the enlargement of this portion of the prostate is usually slight, and the resulting downward displacement is not noticeable nor important, and is entirely ignored in operative procedures, even in prostatectomy. The enlargement of the pre-urethral portion is small because of the infrequent occurrence of glandular tissue within it, and seems small in comparison with the enlargement of the portion of the prostate behind the axis of the urethra,—the *retro-urethral* part,—representing by far the greater portion and comprising the two lateral lobes and the posterior commissure with its so-called middle lobe. The expansion of any or all of these portions, lying as they do behind the axis of the urethra and below the neck of the bladder, would result in displacement upward of the vesical neck and floor, and elongation of the prostatic urethra with elevation of its vesical end, but the form of displacement would vary as the enlargement of the middle or lateral lobes predominated. Thus in lateral lobe enlargement we would expect greater elevation of the bladder neck and distortion of the urethra, while from middle lobe enlargement greater elevation of the bladder floor. The height of vesico-urethral elevation depends (1) on the degree of enlargement of the retro-urethral prostate and (2) the amount of resistance which the bladder and urethra exert against its expansion, in comparison with that exerted by the other surrounding structures, for greater resistance in other directions must result in greater expansion upward. If resistance was, as a rule, greater on all sides than above, we would expect to find expansion upward out of proportion to expansion downward and in other directions, and, when such resistance was extreme, upward expansion only with marked vesico-urethral elevation; but when resistance was slight, then little expansion upward even in great enlargement. And such are the anatomical findings. We occasionally observe large prostates with marked downward, and therefore but slight, vesico-urethral displacement, causing no urinary obstruction. Of those which do cause marked obstruction, we find a considerable number with little or no downward expansion;* some small enlargements *with great upward expansion; and, in the vast majority* of the clinically observed cases, the downward is much less than the upward expansion. From these findings it must be inferred that were the retro-urethral prostate free to expand downward away from the urethra and bladder, prostatic hypertrophy would never cause displacement of these organs nor interfere with the evacuation of urine; that certain adjacent structures do, as a rule, resist expansion in all directions more than upward.

Of the structures placed in front of the retro-urethral prostate, the urethra, the anterior isthmus, the prostatic sheath, the pubic arch, and the triangular ligament, with the exception of the urethra, all offer sufficient resistance to prevent expansion forward. Of the inferior structures, we have first the fibrous sheath, the natural support of the prostate; then the levator ani on each side of the rectum and below, the posterior half of the perineum. Among these it must be the prostatic sheath which offers the greatest, in fact the only, hinderance to expansion downward, because, as a supporting ligament, it would oppose pressure from above, particularly against its lower portion, where it is strongest;† and since it is the only structure which can and does resist prostatic expansion laterally and behind, it must do so equally below. Opposition from the levator ani and perineum can only operate when the sheath has given way.

The mechanism of interference with urinary evacuation through vesico-urethral elevation in prostatic hypertrophy can be attributed to several factors. (1) To inefficient bladder drainage caused by elevation of the outlet of the urinary reservoir. (2) To incomplete emptying of the bladder through limitation of the vesical movements. Normally, the bladder *outlet is on a level with its floor, so that drainage is perfect.* Any elevation of the outlet raises the level of drainage, thereby *requiring extra force to raise up and expel the urine below that* level. The movements of the bladder are complicated; first, the neck and floor of the bladder sink slightly downward and forward,* still further lowering the level of exit and straightening the intrapelvic urethra. At the same time the vesical sphincter dilates, followed by contraction of the bladder-wall. The overgrown and encroaching prostate prevents this sinking of the outlet and renders the bladder floor rigid, inhibiting proper vesical contraction. We would expect from elevation of the bladder outlet, residual urine offering a favorable condition for stone formation and infection; from insufficient bladder contraction, a compensatory hypertrophy of the vesical musculature and frequent micturition due to the efforts of the bladder to wholly expel its contents; and a congestion of the vesical outlet and urethra from obstruction to the efferent circulation of these parts with a tendency to retention of urine. These results tally exactly with the signs and symptoms which we hold as characteristic of prostatic hypertrophy.

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*According to Motz, one-third of all tumefactions of the prostate cannot be diagnosed per rectum, and cystoscopic examination upon most men past middle age reveals irregular elevations of the lower margin of the vesical neck when no other signs of prostatic enlargement are present.

†Von Frisch ("Die Krankheiten der Prostata," Wien, 1899, page 1). "Zwischen Rectum und Prostata ist die Kapsel am stärksten (Fascia rectovesicalis)."

The Treatment of Urinary Obstruction due to Vesico-Urethral Elevation.—As was noted earlier, the logical aim of efforts to relieve the functional derangement of an organ due to its displacement should be directed towards preventing the displacement; or to correcting it sufficiently to allow the organ to functionate satisfactorily, without injury to the organ or undue risk to the patient. To prevent vesico-urethral elevation, two ways are open: (1) by the prevention of prostatic hypertrophy and (2) by preventing expansion upward towards the bladder. Likewise two means are at our command to correct the elevation, (1) by establishing free urinary drainage artificially and (2) by reducing the elevated bladder and urethra.

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* This phenomenon can be readily demonstrated by rectal examination. Just previous to the passage of the urine, it will be noted that the retro-urethral prostate sinks downward and forward and the bladder floor drops within easy reach. This movement of the prostate seems to follow the arc of a circle whose centre is the point of attachment of the puboprostatic ligament to the pubes, and is probably brought about by dilatation of the vesical sphincter and intra-abdominal pressure acting from above and relaxation of pelvic diaphragm below.

Preventive Measures.—The prevention of hypertrophy of the prostate necessitates knowledge of the exciting causes of which we are as yet in total ignorance. The many theories which have been advanced in nearly every instance have been refuted. The Guyon-Lannois hypothesis attributing hypertrophy to arteriosclerosis of the prostatic arteries was exploded by the results of Casper's * investigations. So have the findings of Socin and Burckhardt, that hypertrophy occurs very frequently as early as the third decade, controverted the beliefs of the older writers that overgrowth was part of a senile tissue change. In like manner the claims of other ascribed causes, such as gonorrhœa, congestion, etc., have met with strong contradictory evidence. Belfield ("Progressive Medicine," December, 1902) anticipates the discovery of the cause in a perverted testicular secretion; but it is difficult † to see how this could affect the prostate. It seems more rational to look for the cause in a perverted prostatic secretion, ‡ from the chemical action of pathologic proteids resulting from irregular metabolism or derived from disintegration of the secretion, or in the unusual action of tissue enzymes. However it may be, until the exact cause of prostatic hypertrophy is known, the possibility of preventing urinary obstruction by thwarting overgrowth of the prostate is beyond any immediate hope, and our only recourse lies in diverting the direction of expansion away from the bladder.

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* Casper found in his study of twenty-four cases of hypertrophy, arteriosclerosis of the aorta in all, of the kidney in eight, of arteria vesicalis in eight, of small vesical arteries in nine, and of the prostatic and periprostatic vessels in four.

† A perverted testicular secretion could affect the prostate in but two ways: (1) Indirectly by influencing the testicular control of prostatic nutrition and growth (White's theory), or (2) by the direct local action of the secretion upon the prostate. To reach the prostate, this secretion must pass through the prostatic ducts from the urethra. Were this possible or frequent, we would expect as well the infiltration of urine.

‡ There is probably no secretion which contains such a varied and apparently heterogeneous collection of organic and inorganic substances, and which exhibits greater variations, not only in different individuals but in the same individual at different times. There is no organ, therefore, which should be more prone to secretory perversion and to morphological change as a result of such perversion. For the chemistry of prostatic secretion, the reader is referred to the excellent article by H. Stern (*American Journal of the Medical Sciences,* August, 1903).

The prevention of expansion of the prostate upward requires the removal of forces opposing expansion in other directions, in establishing a point of least resistance downward, forward, or laterally. This is anatomically easiest of execution by relieving the inferior resisting structures, thus attempting to copy those cases, sometimes seen, of great downward but with little or no upward expansion. The release of the resistance of the inferior forces is easiest, because the structures representing the resistance—the prostatic sheath, the levator ani, and the perineum—are the most accessible. This would be accomplished by division of the sheath and the edges of the levator ani through a perineal incision. This should permit of free expansion in a downward direction. The clinical application of such measures would be impracticable except in particularly early cases, because prostatic hypertrophy is rarely recognized until displacement of the bladder has occurred. Theoretically, the application of such a procedure in early cases is sound, requiring but simple operative trauma, with conditions favorable to primary wound healing before advancing years have lessened the recuperative powers, and before urinary infection with its grave sequelæ had set in.

CORRECTIVE MEASURES.

(1) *By Establishing Artificial Urinary Drainage.*—Long ago the importance of relieving urinary obstruction in prostatic enlargement and giving free exit to the retained urine was recognized, and, before surgery had come to the point of attacking the obstructing prostate, the bladder was drained artificially by suprapubic cystotomy and through the perineum. In mod-

ern times, except in extreme cases, these procedures have been abandoned, because in affording relief they create another condition almost as bad. E. Goldman (*Beiträge zur klinischen Chirurgie,* Band xxxi, Heft *1*) has recently advanced a new method of artificial drainage which leaves the elevated bladder outlet and floor undisturbed, but attempts to raise the fundus of the bladder. Observing that urinary evacuation invariably improved in those prostatics upon whom suprapubic puncture had been done for retention, and concluding that this was due to elevation of the fundus from adhesions, he proposed a *ventrofixatio vesicæ,* which he has performed with some success. The mechanical principle of this procedure is correct. To raise the body of the bladder to the level of the elevated outlet would induce thorough drainage, but to do so in a collapsible organ like the bladder, weighted down with accumulating urine, by dragging up its apex and attaching it to the abdominal wall, is impossible except in such a limited degree that could only afford moderate relief, varying with the amount of elevation of the outlet. Even were it possible to satisfactorily suspend the fundus of the bladder, the operation could never prove so successful in its results as one which reduces the vesical elevation and brings about normal urinary drainage.

(2) *The Reduction of Vesico-Urethral Elevation.*—This is the only logical plan, both anatomically and mechanically, for the correction of this condition. By reducing the elevated neck and floor of the bladder, we would expect to obliterate the retroprostatic pouch, to establish normal urinary drainage by straightening the intrapelvic urethra, and by bringing the level of the exit of the urinary reservoir down to its lowest point. As a result, we would expect complete evacuation at micturition with no residual urine; relief of muscular overstrain in the effort to overcome obstruction with cessation of vesical hypertrophy; and conditions favorable to either preventing or curing urinary infection since the infection soil, the residual urine, is removed. The remote effects of obstruction and infection, hypertrophy of the bladder, etc., are beyond aid, though they may be prevented. To reduce the vesical elevation has been

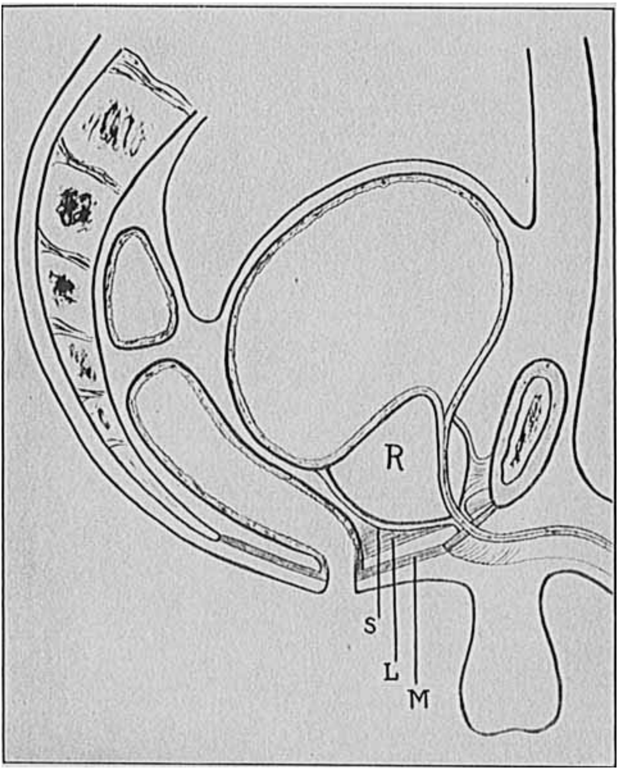

FIG. 4.—Diagrammatic sagittal section of male pelvis showing vesico-urethral elevation due to enlargement of the prostate and the structures supporting the elevation. R, Enlarged surgical prostate; S, prostatic sheath; L, levator ani; M, recto-urethral muscle.

the real, if not conscious, aim of almost all operative measures, new and old; but from the beginning the high mortality * has hindered all but the bold or enthusiastic, and has caused a strong prejudice in the minds of all conservative surgeons despite the improved technique of prostatectomy and allied procedures. The reason of such mortality has been thoroughly understood; the advanced age of the subjects when renal insufficiency and arteriosclerosis are almost certain, and when resistance to operative shock, to infection, and to hæmorrhage is lowered; and when the ureters and kidneys are often infected.

From radical methods surgery turned to moderate ones in the hope of evolving an operation which would be both effectively curative and safe. From failure in these temperate procedures, because of the hopelessness of their ever proving successful and even because of their surprising mortality, the tide has again turned to radical measures in the endeavor to lessen the dangers by improvements in technique. For the operative relief of urinary obstruction in prostatic hypertrophy will never serve its true purpose until it can be applied easily and safely in early cases before urinary infection, catheter-life, retention,

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*SOCIN AND BURCKHARDT'S TABLE.

Operation.	Author.	Number of Cases.	Improvement of Complications and great Improvement of Function.	Noticeable Improvement.	No Relief.	Deaths.
			Per cent.	Per cent.	Per cent.	Per cent.
Castration.......	Emil Burckhardt.	210	69 (32.8)	64 (30.4)	43 (20.4)	34 (16.2)
Vasectomy	Emil Burckhardt.	252	62 (24.6)	87 (34.5)	82 (32.5)	21 (8.3)
Angioneurectomy	Emil Burckhardt.	18	(5.5)	(77.8)	(11.1)	(5.5)
Bottini..........	Freudenberg....	690	No mention.	597 (86.5)	57 (7.8)	39 (5.6)
Suprapubic prostatectomy	Burckhardt......	77	11	20	24	16
Perineal prostatectomy	Burckhardt......	53	No mention.	(60.1)	(28.9)	(12.2)

and reduced vitality of advancing age have set in, before urinary obstruction has wreaked its fullest harm. Until it has reached such a stage of perfection that it can be universally applied to incipient cases, and thus prevent the grave consequences of obstruction and infection, operative procedure must be one of last resort, justifiable only in selected cases and in the hands of the skilled, and not before then will it have any place among the standard and elective operations.

To reduce any elevation requires the release of forces maintaining it, and the greater the height the more extensive must be the removal of these forces. While there may be many ways of reducing an elevation, the one which is simplest, safest, and yet effective must hold, especially when injury to the elevated structure is to be avoided and the necessary damage minimized. The forces maintaining vesico-urethral elevation are represented by the structures situated beneath it. Of these, first comes the retro-urethral prostatic mass and, immediately enclosing this below, the strong, supporting prostatic sheath or ligament. These two structures represent the chief support of the elevated urinary organs. Below them we have the separated levatores ani with the rectum between, and the posterior half of the perineum filled in by the recto-urethral muscle, with the fascia and skin externally. With but few exceptions, the great variety of operations now in vogue attempt vesical reduction by directly and indirectly releasing the *prostatic support* through shrinkage of the *retro-urethral prostatic* mass or through removal of it.

Operations for Shrinkage of the Prostate.—Theoretically, reduction by prostatic shrinkage would be ideal could it be made extensive enough to bring about complete reduction without great injury and risk. The operations having this end in view include the so-called sexual * operations (castration, vasectomy,

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* The Russian, Professor Sanitzin, of Moscow (1886), was the first to clinically demonstrate a case of decrease in size of an enlarged prostate following castration.

Fredrik Ramm, the Norwegian, was the first to *experimentally* note angioneurectomy, etc.) and Bottini's galvanoprostatotomy with its numerous modifications. The sexual operations are based on the fact that empirically some prostates do shrink, and that experimentally atrophy of the glandular tissue of the prostate results. The degree of shrinking must vary with the proportion of glandular tissue in the hypertrophied organ. In pure adenomata, which are rare, we would expect complete diminution in size, but in the large majority, where considerable increase in the fibromuscular tissue exists, only such slight decrease in size as would but slightly influence the elevated bladder. That such is the case is substantiated by the small percentage of cures and the large proportion of " improvements" recorded. Even were the resulting atrophy greater, the operative risk is by no means small. The sexual operations must soon find an early abandonment.

The Bottini * principle relies on shrinkage by the actual destruction of a certain amount of prostatic tissue and by the resulting contraction of the scar tissue. It attacks the uppermost portion of the retro-urethral prostate, the so-called obstructing mass. It does diminish the size of the protruding mass, but only to a degree, and cannot do so thoroughly without extensive destruction. As would be expected, it results in improvements varying with the amount of the vesical elevation. Besides its failure in causing effective reduction, it necessitates injury to the bladder, which sometimes extends to other structures, as the ureter and rectum, and even under improved

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prostatic atrophy after castration and to perform this operation with purpose aforethought (April, 1893).

But to White, of Philadelphia, belongs the credit of the extensive introduction of the sexual operations upon wide and thorough experimental work.

Following castration came ligation of the spermatic cord (Erving Mears, 1894); division of the cord (Lauenstein, 1895); excision of cord (Pavone, 1895); ligation of vas (Tilden Brown, 1896); division of vas (R. Harrison, 1896); vasectomy (Lennander, 1897); and angioneurectomy (Albarran, 1897).

* The late Bottini, of Pavia, working on Mercier's principle of prostatotomy, designed an instrument (the galvanoprostatic incisor) for performing prostatotomy with a cautery blade (1874). Many modifications

methods of application it is unsurgical and productive of no small death-rate.

These many and varied operations attempting the removal of the obstruction, or, more accurately, the reduction of the vesical elevation, by shrinkage of the retro-urethral prostate represent the conservative digressions of surgery in reaction from radical measures. While curative, if they could decrease the prostate to normal, the actual decrease is invariably so slight that they can never avail of more than uncertain and unsatisfactory improvement. It is this "improvement" which has encouraged continuance of these procedures, but to produce uniform and complete reduction appears anatomically impossible.

Operations for the Removal of the Retro-Urethral or*

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of the Bottini incisor have followed upon the original, the most important ones being the cystoscopic instruments of Freudenberg and Bierhoff, and of Jacoby. But more important have been the modifications of technique. Kümmel first argued the value of visual guidance in applying the cautery, and in 1889 practised galvanoprostatotomy per suprapubic cystotomy. Belfield and Wishard (1890) carried out the same idea through a perineal section, and Chetwood has recently perfected this procedure and devised a new instrument to this end.

* Records show that Guthrie, the English surgeon, was probably the first (1834) to execute prostatectomy which was performed by the perineal route. Two years later the French surgeon, Amussat, removed the prostate by the suprapubic approach. Although suprapubic prostatectomy was performed by Dittel in 1880, it was not resurrected successfully until 1886 by Belfield and by McGill (1887). While supported for a time, of late the great majority of its adherents, with the prominent exception of Freyer, have abandoned this route for the perineal.

Although perineal prostatectomy was practised at intervals, Fergusson (1848), Keyes and Socin (1874), it has not experienced any special degree of development until quite recently. Belfield (1890) introduced the combined suprapubic and perineal method, and Nicoll (1894) modified it by excision without first opening the urethra. Alexander (1896) advocated the combined method, adding perineal drainage and enucleation by the finger from the urethra. Albarran and Hugh H. Young have still more perfected perineal prostatectomy by reducing the injury to the urethra, bladder, and ejaculatory ducts. The lateral perineal method was proposed by Dittel (1890) after experiments on the cadaver, and was first performed by Küster (1891). Prostatectomy was accomplished per rectum by Schuh in 1856 and reintroduced by Robertson, of California, in 1891. But these last two methods have never received much support.

Surgical Prostate.—Several methods have been devised to this end, and are classified, according to the route by which exposure of the prostate is obtained, into the median and lateral perineal prostatectomy, combined suprapubic and perineal, suprapubic, and rectal. The first three execute removal through the perineum, while the latter approach through adjacent viscera; the suprapubic requiring two incisions into the bladder before the prostate is reached. Each method removes by excision or enucleation the obstructing mass, the retro-urethral prostate. The remote and harmless pre-urethral prostate is untouched. The principle upon which prostatectomy is curative is radical in the extreme. It not only accomplishes, but exceeds the requirements. The elevated floor and neck of the bladder only require reduction to their normal level. Prostatectomy does this and more. It removes the support which the prostate and its sheath naturally furnish to the neck of the bladder. The operations for the removal of the prostate succeed where the conservative ones fail in that they effectually reduce the elevation, but, whereas the latter are attended with comparatively little risk, prostatectomy is notoriously a grave operation. It is undeniably true that the technique has greatly improved, especially the perineal operation performed by Albarran and the French school, and Young, of Baltimore, and that the mortality has been reduced in the hands of a few in selected cases. Yet prostatectomy has not been sufficiently shorn of its dangers to qualify its general application as some claim. Moreover, the injury to the bladder and urethra is not infrequently permanent. Enucleation of the surgical prostate is practically impossible without damage to the urethra and neck of the bladder, and permanency of this condition is far more common than supposed. Incontinence and loss of urinary control are the result and, though perhaps a less serious condition than the original, are very distressing. Published reports mention cure, improvement, or non-improvement of the urinary obstruction with exceptional reference to this untoward sequela. It must be said, however, that prostatectomy has gained new advocates, and that consensus of opinion declares its value in chosen cases. In the failure of conservative methods it will surely survive. The criticism of prostatectomy from a mechanical stand-point is that it attempts the reduction of an elevated structure by attacking the highest and most inaccessible supporting structure, and one which is adjacent and adherent to it, and that in so doing it necessarily injures the vesical elevation and exceeds the required reduction by removing the natural inferior vesical support. In other words, it attempts a mechanical task by the most difficult means.

Two New Operations removing the Inferior Supporting Structures.—As was noted, the structures supporting the vesical elevation, besides the overgrown retro-urethral prostate, are the prostatic sheath, levatores ani, and perineum. Two operations, avoiding the uppermost but attacking the lower ones, have been proposed. E. W. Andrews (*Journal of American Medical Association,* October 18, 1902), arguing that were the prostate freed from the fixed space behind the pubes it would expand and cure obstruction, devised an *infrapubic section,* through which he divides the levator ani of one side and the puboprostatic ligament, and removes extra-urethrally a segment of the pre-urethral prostatic ring. This procedure releases but slightly two of the inferior supporting structures,—the levator ani on one side and the prostatic sheath above, and not where it can result in much reduction. The mechanical criticism of this method is that it does not attack the sheath and pelvic muscle from below at the point where they exert greatest support and are easiest of approach. Moreover, the degree of reduction obtained would be inadequate.

The second operation is that of H. Delageniere (*Archive Provincial de Chirurgie,* 1902), and called by him *subperineal prostatopexy* or *dislocation of the prostate.* The feature of this operation is that the retro-urethral prostate, after being freed from the capsule or sheath below, as in perineal prostatectomy, is drawn or dislocated downward. The principle involved is that the most important supporting structure, the sheath, is removed, permitting the prostatic mass above to sink, and with it the elevated bladder floor and urethra. Whether the reduc-

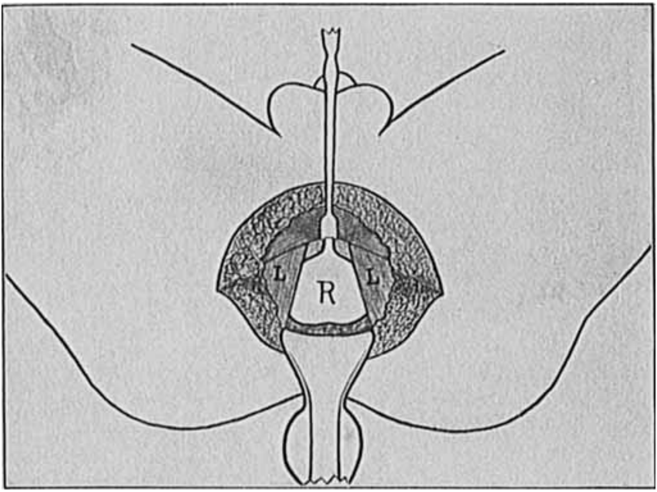

FIG. 5.—Diagrammatic sketch of the field of operation after liberal perineal incision and division of recto-urethral muscle. Kocher's inverted V, Senn's inverted Y, or Zuckerkandl's horseshoe incision (as above) are necessary for adequate exposure. Division of the margins of the levatores (L) on each side is not difficult, and can be limited to the width of the retro-urethral prostatic mass (R). Longitudinal or transverse incision of the prostatic sheath with digital stripping of it from the lower and lateral surfaces of the prostate permits eversion of the latter downward. Removal of segments of the outer and lower portions of the lateral lobes is possible without injury to the urethra, ejaculatory ducts, or bladder. Sections sliced from the lateral surfaces of the retro-urethral prostatic mass narrow it, and allow it to drop between the levatores ani, while sections from the inferior surface bring about greater dislocation downward of the upper protruding mass.

tion obtained is sufficient depends upon the height of the elevation. That it must often fail is evidenced by the author's recommendation that it gives way to total enucleation in enlargements of much size.

Mechanically speaking, the principle of these two operations is correct in that by removing the inferior support it induces reduction without injury to the elevated structures, the bladder and urethra. But they do not go far enough, and no method can be successful which does not permit of complete reduction for all degrees of elevation.

The Problem of reducing Vesico-Urethral Elevation.—As was noted, the reduction of the elevated vesical neck and urethra requires release of the supporting structures maintaining such elevation, viz., the overgrown surgical prostate, the levatores ani, and the perineum. How can this be accomplished in the easiest manner and yet effectively and without injury to the elevated parts or undue risk? Mechanic principles teach us that the task of reducing an elevation is usually most simply and completely performed by removing first the lowest and most accessible support, then the next higher, and so on, till the required reduction is obtained; that we should expect to find the simplest method in removing perineal support, then the levatores, then the prostatic sheath, and, if necessary, segments of the lower portion of the prostate sufficient to permit downward displacement of the upper protruding portion. Anatomically, such a procedure seems to bear out the mechanical claims. Release of the support of the perineum and levatores ani would induce a certain degree of sinking of the bladder floor, as rupture of the perineum does in the female, were it not that it is supported by the prostatic sheath and the surgical prostate. Release of the prostatic sheath would free the prostate of its greatest support and permit it to fall, and to fall farther than in Delageniere's operation, because more room is given the prostate to sink into by the released perineal support, and therefore to produce greater reduction. Removal of the inferior portions of the retro-urethral prostate would permit of dislocation downward of the upper protruding portion, and with it reduction of the elevated bladder and urethra.

Anatomical Experiments.—To test the possibilities suggested by this study of the mechanics of reduction, I followed out the principle involved upon three prostatic subjects postmortem. In each case Zuckerkandl's bi-ischial perineal incision was made, exposing the bulb of the urethra and the posterior half of the perineum. The support of the latter was released by dividing the recto-urethral muscle just behind its attachment to the bulb. This served another purpose besides weakening perineal support, namely, enlarging the operative field by allowing the rectum to drop backward. The levatores were then divided, still more enlarging the operative field and facilitating exposure, and the prostatic sheath opened along the under surface of the prostate from apex to base. The sheath on each side was separated from the lateral and under surface of the retro-urethral prostate by the finger (as in prostatectomy). In two cases the bladder was opened above, only to experimentally confirm the extent of reduction of the neck and floor of the bladder, and in all three a Thompson searcher was introduced through the urethra for the same purpose. After freeing the sheath, the prostate was dislocated downward, very readily in one case but only slightly in the others, because of considerable size of the lateral lobes. In each case the reduction of the elevated neck of the bladder was very plain but insufficient. In each case sections were removed from the outer and lower portion of each lateral lobe. This resulted in still greater reduction, and, in one case where the enlargement was almost entirely of the middle lobe with marked upward projection of the bladder floor, the latter disappeared entirely. In each case the reduction seemed complete; the retroprostatic pouch was obliterated and good bladder drainage restored, except in one subject, where the pouch was large and trabeculated. In each case the urethra and bladder and ejaculatory ducts were uninjured, and enough of the prostate remained untouched to perform its functional purposes, in all probability. In each case the searcher indicated accurately the degree of reduction obtained. In each case the steps were easily carried out; the operative damage was slight, —slight compared with prostatectomy with its unavoidable injury of the urethra,—and the resulting wound was superficial and capable of being made surgically clean. It was noted that even in moderate elevations it would undoubtedly be necessary to remove small sections of the lower prostate. That this method reduces vesico-urethral elevation effectively and by an operative procedure comparatively simple and harmless in character was confirmed by these experiments. Of its possibilities I was impressed at the time, and that it was a sufficiently safe and easy operation for general application.

I feel convinced that this method is appropriate in early cases of prostatic hypertrophy before the urinary tract has become infected and disorganized because it can be carried out as an aseptic operation with all that means; because the urinary organs are uninjured, and because the operative risk is seemingly small. Prostatectomy, on the other hand, fails as a justifiable measure in early cases for the reason that it is hazardous, needlessly opens the non-infected urinary tract, and requires drainage. In advanced cases with cystitis this method can be combined with perineal urethrotomy if desired. In aged and very advanced cases, where renal and other complications are present and a general anæsthetic contraindicated because of its superficial character, it might be executed under local infiltration anæsthesia. In cases where the degree of elevation varies, the extent of operative procedure can be gauged according to requirements. This method of reducing the vesico-urethral elevation in prostatic enlargement is yet purely a suggestion,—a suggestion based on analysis of the mechanical problem involved, and confirmed by anatomical experiment. Although untried clinically, it should accomplish reduction more satisfactorily than prostatectomy, the only method which successfully effects reduction. It is directly opposed to prostatectomy in that it attacks the inferior supporting structures, avoiding attack on the protruding prostatic mass above, while prostatectomy attacks this mass above, avoiding injury to the pelvic and perineal support below. While prostatic surgery has always shunned injury to the pelvic floor, the harm of removing perineal support in the male is unknown, and is probably *nil,* because, unlike the female, there are no other important pelvic organs except the bladder to prolapse. Support of the bladder floor, following this method, would be maintained by the portion of the retro-urethral prostate remaining and the cicatrix filling in the perineal wound below. Prostatectomy, on the other hand, removes all support except the pelvic and perineal floor.

The conclusions which are to be drawn from the analysis of the problem in prostatic hypertrophy are:

(1) That it is not the prostate but the adjacent urinary tract which demands relief.

(2) That the direct cause of the interference with urinary evacuation is the displacement of the outlet and floor of the bladder resulting from enlargement of the retro-urethral portion of the prostate.

(3) That until the precise cause of prostatic overgrowth is known and successful preventive measures evolved, we can only hope to relieve this condition by correcting the displacement.

(4) That until an effectual method which is sufficiently safe and simple for application before infection and disorganization of the urinary tract has resulted, surgery cannot bring any great relief.

(5) That the logical mode of correcting vesico-urethral displacement is by reduction is evidenced by the fact that operative methods improve urinary evacuation by virtue of their power to reduce, more or less successfully, this displacement.

(6) That while some of these methods partially (sometimes completely) accomplish reduction with comparative safety, and others entirely reduce the displacement, but at considerable risk, none does so with both safety and success.

(7) That since the reduction of the vesico-urethral elevation is essentially a mechanic problem, reduction based on anatomic and mechanic principles should prove the simplest and safest method.

(8) That the method I have described is based on such reasoning and has received satisfactory confirmation through experimental work. That it will prove sufficiently safe and effective for general application, clinical results alone can show.

Ever since Morgagni discovered that the dysuria and urinary obstruction common in old men was due to an enlargement or hypertrophy of the prostate, surgery has attempted relief by removing in one way or another the " prostatic obstruction or obstacle" as the only curative or corrective measure. That hypertrophy is the cause of this form of dysuria is an established truth. That it is the indirect, and displacement of the urinary tract the direct, cause, examination of the bladder and urethra in these cases will prove. That reduction of the vesico-urethral elevation was the mode of relief and removal of the prostatic obstacle unnecessary to the " cure of obstruction," was demonstrated to me during a combined suprapubic and perineal prostatectomy. It was observed that, after the prostate was freed from its sheath and before it was removed, traction obliterated and corrected the bladder deformity. How to accomplish this without excision of the prostate and injury to the bladder led to a study of mechanics of displacement and anatomical experimentation as herein briefly put down.